研究報告

TOWARD A SYMBIOTIC CO-EXSISTENCE OF ENERGY AND PEOPLE: IMPORTANCE OF COORDINATING INSTITUTIONAL ARRANGEMENTS AND RISK COMMUNICATION

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ABSTRACT

The present paper discusses both psychological and institutional factors relevant to the siting of power plants in Japan. First, a preferability of co-existence of hard- and soft-energy paths is examined. Secondly, usefulness and limitations of risk communication are analyzed in relation to the 'word vs. deed' paradigm. Thirdly, the importance of various institutional arrangements is discussed with respect to developing a symbiotic scheme for power plants and people living in neighboring communities.

1. THE JAPANESE AMBIVALENCE

Strong ambivalence and mixed feelings characterize current Japanese attitudes toward nuclear power and related matters. Mixed feelings involve both acceptance of nuclear energy as a necessary and important energy source, and fear of it as a source of radioactive contamination. Such ambivalence has persisted since the first commecial reactor was put into operation at Tokai Mura in 1966; and it was further magnified by both the Three Mile Island and the Chernobyl accidents.

1.1. Futurism and determinism as the Japanese philosophy of energy

Recent national public opinion polls regarding energy[1][2] seem to indicate

that the Japanese are not only ambivalent to nuclear power, but also to future energy alternatives at large. Contrary to a common-sense speculation, a great majority of the Japanese (nearly 80%) are found to accept a continued use of nuclear power in 1990. While a majority of the Japanese (33%) hold that both the nuclear and the oil will be the major source of energy in 2000, only a minority (20%) think that the solar energy will be the major source of energy in 2000. On the other hand, the Japanese are sharply split in their opinion regarding nuclear safety (51% consider it safe, and 49%, dangerous). It is also noteworthy that only a minority of the Japanese (30%) consider that nuclear power serves for the purpose of environmental protection.

Taken altogether, the general philosophy of energy in the Japanese may be summarized as follows:

"It is not true that nuclear power does not disrupt the environment. It is true that nuclear energy emits neither NOx nor CO_2 but it generates harmful radwaste. Despite this, the preferred soft-energies are still beyond reach at present. Hence, at leat toward 2000, we cannot but continue to use the nuclear power along with the oil and the hydro."

The Japanese philosophy of energy is thus highly 'futuristic' because the future is imaged as safer and more hopeful than the present. It is also 'deterministic', because the Japanese are aware that the actual energy alternatives are 'finite' (nuclear, oil, and solar) and little wishful thinking is possible. It seems certain that the post-Chernobyl Japanese are swaying between futurism and determinism and increasingly tend to lean to soft-energies toward 2000.

2. WHO OPPOSE THE HARD-ENERGIES

It is commonly believed that women generally are more sensitive to risks than men. To test this hypothesis, a study was carried out in 1990 by the present investigator with 500 Tokyo housewives serving as subjects. [3]

2.1. Perceived risk and benefit

First, perceived risk and benefit of 9 man-made objects are measured on 4-point 'risky-not risky' and 'beneficial-not beneficial' scales. Using the mean scale scores computed for each concept, it was found that the 9 objects can be classified into four categories: (1) low risk/high benefit; (2) medium risk/high benefit;(3) high-risk/low benefit; and (4) high risk/high benefit. Table 1 summarizes the rersult of this comparison.

TABLE 1. PERCEIVED RISK AND BENEFIT OF 9 OBJECTS.

(1)LOW RISK/HIGH BENEFIT:
herb medicine
vitamins
(2)MEDIUM RISK/HIGH BENEFIT:
nuclear power plant
oil power plant
travel by air
(3)HIGH RISK/LOW BENEFIT:
food additives
spray using CFC (chloro-fluoro-carbon)
smoking
(4)HIGH RISK/HIGH BENEFIT:
automibile

Considering a psychological tradeoff between risk and benefit, each of the three 'high risk/low benefit' objects may be regarded as most socially objectionable,

whereras each of the two 'low risk/high benefit' objects may be viewed as socially most preferred. It may be a logical conclusion that people are inclined to reject what is perceived as the most socially objectionable, while they are willing to accept what is regarded as the most socially preferred. Both 'vitamins' and 'herb medicine' are thus classified to the most preferred group. That 'herb medicine' is classified as one of the most preferred may suggest the presence of a unique traditional value-attitude characteristic of the Japanese. 'Nuclear power plant', proves to be as acceptable as are 'oil power plant' and 'travel by air', even if it is not classified to the most preferred. 'Automobile' is perceived at the same time as highly risky and as highly beneficial. On the other hand, 'food additives', 'spray using CFC' and 'smoking' are classified to the most objectionable.
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2.2. The clustering of 500 Japanese housewives

Secondly, a statistical analysis called 'cluster analysis' was carried out in order to examine how 500 housewives can be 'segmented' into several independent groups on the basis of both their demographic attributes and their attitudinal characteristics regarding 'social participation' and 'perceived risk and benefit'. Five meaningful clusters were obtained as the result of this analysis. Each cluster was then named, according to unique demographic attributes and attitudinal characteristics of the component subjects. The name of clusters and their typical characteristics will be summarized as follows.

Cluster-1/The conservative activists (N=72; 14%):
Mostly in the 30-40 age group; mostly highschool graduates; many are working; interested in participating in anti-nuclear-weapon, anti-nuclear-power, anti-pollution protests; interested in political and economic affairs; perceiving nuclear energy as being dangerous but beneficial.

Cluster-2/The optimistic silent majority (N=121; 24%):
Some are in the 20-30 and many are in the 30-40 age group; mostly highschool graduates; few are working; not interested in environmental problems, political and economic affairs, and nuclear-energy issues; perceive nuclear energy as being both safe and beneficial.

Cluster-3/The socially indifferent (N=56; 11%):
Mostly in the 40-50 age group; mostly highschool or trade-school graduates; not interested in environmental problems, political and economic affairs; not interested in participating in anti-nuclear-weapon, anti-nuclear-power, or anti-pollution protests; perceive nuclear energy as not being beneficial.

Cluster-4/The progressive activists (N=56; 11%):
Mostly in the 30-40 age group; mostly university, college, and junior-college graduates; only few are working; interested in political, economic, and international affairs; interested in participating in various volunteer activities, anti-nuclear-weapon and anti-nuclear-power protests and peace demonstrations; perceive nuclear energy as being both dangerous and not beneficial and perceive oil energy as being not beneficial; highly critical of nuclear power plants as not being in safe operation; believing that the science does not contribute to enrichment of life.

Cluster-5/The representative silent majority (N=195; 39%):
Mostly in the 30-40 age group; many are trade-school graduates; few are working; interested in viewing TV's sports programs and reading shopping magazines; not interested in anti-nuclear-weapon and anti-nuclcear-power, anti-pollution protests; perceive nuclear energy as being beneficial.

3. SEGMENTED PUBLICS AND RISK COMMUNICATION

The foregoing clustering of 500 Japanese housewives may well illustrate the ways in which they are segmented into 5 groups and how these 5 groups are found to differ in their average demographic attributes and attitudinal outlook. Although the result may be highly culture-bound, it can still be seen that those housewives in Cluster-4 named "Progressive activists", who are more highly educated, politically and socially more aware and more active, and non-working, constitute outright opponents to the hard-energy, especially the nuclear power. Not only are they anti-hard-energy, but they are also skeptical of the role of science. Contrary to the common-sense, higher education and richer knowledge seem to convert Japanese housewives to being more anti-hard-energy, more anti-nuclear and more anti-science .

The foregoing findings empirically demonstrated that "the audience of risk communication are almost never homogenous." This poses an interesting but serious problem for the pursuit of effective risk communication, whose basic purpose is defined as "encouraging lay publics to understand the nature of risks rationally and avoid these risks wherever it is possible." In the previous case of 500 Japanese housewives, there are at least five different segments (or clusters) of the audience; ranging from those who are totally indifferent of both energy issues and social and political affairs; through those who are aware of energy issues and conditionally accept nuclear power; to those who are aware of energy issues but totally reject the hard-energy. Consequently, it is false to assume that there is 'the public'. There is no single 'public'. There are many 'segmented' publics, who differ in their demographic attributes and value/attitude complex.

Risk communications, therefore, should be addressed to each of these segmented publics, by using appropriate 'strategies', by selecting appropriate 'methods' and 'media', and by encoding appropriate 'messages'. In view of the effectiveness of risk communication, it should also be remembered that the best

message is not by word, but by deed. A repeated promise by word of nuclear safety and usefulness would only serve for reducing credibility and the public trust, until or unless it is backed up by actual deed. In our post-Chernobyl era, therefore, nuclear safety and usefulness would never be perceived as being real, until the world becomes well devoid of serious nuclear accidents.

4. CO-EXISTENCE OF HARD- AND SOFT-ENERGY PATHS

The result of recent opinion polls indicate that a majority of Japanese expect the mix of hard- and soft-energies to come into reality in 2000. It is worthwhile to conjecture whether the mix of hard- and soft-energies or their co-existence may be psychologically acceptable. Just consider the popular belief among lay publics in Japan that the nuclear power constitutes a major cause of environmental disruption by producing radwaste --- a serious threat to several generations of offsprings to come. If this is what a greater majority of people tend to believe today, it would be hardly possible to neglect this popular belief in our democratic society.

Such co-existence of hard- and soft-energies would be rewarding in the long run, despite its possible setbacks. First, in theory, the new steps to co-existence would offer a real challenge, not a retreat, in view of the continuously increasing need for energy whatever means may be required. Second, in practice, the new steps would introduce a new aggressive stance of the industry in such a direction as the publics have long wanted and patiently awaited in search of "safer" energy. They would thus serve to restore the public trust which has severely deteriorated after Chernobyl. Third, in economic terms, despite the initial costs, the new steps would offer to the industry the chance to take an important initiative to create a new generation of commercial energy in a post-fossil- and post-nuclear-fuel age. Fourth, in psychological terms, the new

steps would serve to reduce the tension between the industry and the publics by producing tangible evidence on the long-term as well as the short-term cost-benefit tradeoffs. It may become clear that there are both technological and economic limitations of soft-energy, at least for the time being. And fifth, in a perspective toward the future, the publics, who are 'almost never homogenous', would have a single unobjectionable goal that is common to all segments: the new soft-energy path whatever limitations and problems it may demonstrate. The soft-energy path, in this sense, would be a socio-economic experimentation in an unprecedented scale.

5. INSTITUTIONAL ARRANGEMENTS AS ECONOMIC AND PSYCHOLOGICAL INCENTIVES TO PUBLIC ACCEPTANCE

Economically, nuclear power is a paradox, because despite its dark image connoting "radiation", "radioactive waste", and "Chernobyl", it brings a considerable amount of economic benefit to the localities where nuclear power plants and other nuclear facilities are sited, and to the individuals who might otherwise suffer great loss.[4]

In Japan at present, four different kinds of economic compensation are given to the fishermen who are affected, and to the locality where a nuclear power plant, or a nuclear-related facility such as an enrichment or a reprocessing plant, is to be constructed.

5.1. Fishing-right compensation

First, there is what is usually known as 'the fishing-right compensation', whose purpose is to purchase the right of fishing from fishermen whose catch might be adversely affected by hot waste water from the nuclear power plant. This is paid by the electric company to fishermen's cooperative associations, which

distribute it among members. According to statistics, this compensation averages approximately 10 million yen (or US$80,000) per member of the association. [5]

5.2. Regional development cooperation funds

Secondly, there is what is called a 'regional development cooperation fund', which compensates psychological anxiety which might be caused by the presence of a nearby nuclear power plant. The average amount of this fund per member of a fishermen's association is said to be equal to or a little below that of the 'fishing-right compensation'. In 1984 the national average of these two funds combined amounted approximately 13 million yen (or US$104,000) per 10,000 kW of generating capacity.

5.3. 'Dengen Sanpoh' subsidies

Thirdly, there is a special grant awarded by the national government to local governments in localities where a nuclear power plant is sited, under legislation known as 'Dengen Sanpoh', or the 'Three Laws Pertaining to Sources of Electricity', enacted in 1974. A full grant is awarded to the municipality, town or village where a power plant is sited, while the same amount is divided among the municipalities, towns and villages adjoining it. In othr words, both the nuclear city, town or village, and the surrounding cities, towns and villages, all profit from the presence of a power plant. This grant helps local governments improve both the social welfare of the residents and the infrastructure of the communities. The amount of the award is calculated using the following formula:

Maximum amount = power production capacity
x unit price (yen/kW) x coefficient
x 2 (1 for hydroelectric)

The differential unit prices and coefficients are shown in the next Table.

TABLE 3. SCALE OF NATIONAL GOVERNMENT COMPENZATION TO LOCAL GOVERNMENT

Facilities	Unit Price (yen/kW)	Coefficient
Nuclear power reactor	450	7
Reprocessing plant	350	7
Experimental and testing laboratory	450	7
Research reactor	300	7
Fast breeder reactor	300	7
Enrichment plant	450	7
Fossil fuel power plant	200 - 450	3 - 4
Hydroelectric plant	200	5

In terms of both a higher unit price and a higher coefficient, it is evident that a nuclear power plant will be more profitable to local government, compared with a fossile fuel or hydro power plant.

5.4. Property tax

Fourthly, there is yet another economic benefit for electricity-producing localities--a property tax. In the case of a 1000 MWe nuclear power plant, the tax revenue for the first year is estimated to be as much as 2,300 million yen

(or US$18 million), finishing with 313 million yen (or US$2.5 million) in its 15th (last) year. Considering that most nuclear power plants are sited in depopulated areas with no significant modern industry, a nuclear power plant is not only a major source of revenue to a local government, but is also expected to be an important incentive for attracting more people and business to these desolate areas.

If depopulation goes on, and if the national economy generally should slow down, a nuclear power plant, or any nuclear-related facility, will become more attractive as a source of revenue to a local government. Furthermore, both fishing-right compensation and a regional cooperation fund also tend to be attractive to individual fishermen. Such a trend would be even stronger in smaller fishermen's associations where the catch is less rewarding.

6. THE STALEMATE IN NUCLEAR SITING

6.1. Tactical opposition

Despite all these benefits which might be obtaioned if a nuclear plant were to come, there still remains opposition among local fishermen. It is noted that such opposition is growing even stronger after Chernobyl, as might be expected. Although its major causes may vary from one locality to another, it is frequently true that such opposition may cease if more favorable conditions were to be offered. Sometimes it is a matter of the amount of compensation; sometimes, a matter of sparing enough time to reconcile different vested interests and remove divided opinions among members of a fishermen's cooperative association. Sometimes it might be that opposition is initially a bargaining strategy to win concessions. Tactical (therefore, conditional) forms of opposition such as these may be coped with, case by case, through painstaking

person-to-person communications.

6.2. Money is not sufficient

It should be remembered, however, that money is double-edged. There is a Japanese saying: "Never slap him in the face with a role of bank notes." Furthermore, money can buy neither one's heart nor one's conscience. In other words, while money may be a necessary condition, it is rarely sufficient. True, too much emphasis on economic benefits could hurt the pride and self-esteem of 'persons concerned' and turn them into outright opponents. A Faustian seduction would not always be the case.

6.3. Damage by rumors

Subsequent to the Chernobyl accident, there has been yet another new cause for opposition among farmers as well as among fishermen. This new phenomenon is called 'damage by rumors'. The shock of Chernobyl was so strong among the general populace in Japan that if any anomaly at a nuclear power station is reported in mass media, it will quickly become associated with a critical radioactive hazard---especially a radioactive contamination of agricultural produce. When some anomaly occurs at a nuclear power plant or a nuclear-related facility, therefore, consumers tend to avoid buying the produce from these localities, in fear that it might be radioactively contaminated, harmful to their life.

Farmers and fishermen who live in the localities adjoining to a nuclear-related facility have thus found that 'rumors' are as threatening to their business as could be a severe nuclear accident itself. It is difficult for farmers and fishermen to cope with rumors which are unpredictable and uncontrollable. It is difficult for them to refute rumors in a logical way, because rumors appeal

to the emotion of consumers, not to their reason. Thus, farmers and fishermen were quick to learn that the siting of a nuclear facility in their neighborhood would cause a serious 'damage by rumors' and are inclined to oppose it despite considerable economic profits it might bring to them.

In fact, because of mounting opposition in the localities adjoining to a nuclear site, a lead time between the initial negotiation with the localities and the beginning of reactor operation has tended to extend from the average of 8 years in the 1970's, through the average of more than 15 years in the 1980's, to the average of more than 25 years in the early 1990's. If this trend were to continue, time would come sooner or later when neither farmers nor fishermen would approve the siting of a new nuclear power plant or a nuclear-related facility in their neighborhood. In farmers and fishermen, the risk-benefit balance is thus upset by increasing fear of 'damage by rumors'.

7. SOME SOLUTIONS IN SIGHT

To enhance public acceptance, both 'communication by word' and 'compensations to persons concerned' may be necessary conditions, but they are rarely sufficient. The Japanese cases illustrated above may present good examples. There have to be some solutions for this problem.

7.1. "Micro-level" solutions

First, at the 'micro' level, it may be necessary for both the industry and the national government to develop a more effective system of risk communication so that they can help lay publics better understand the nature of various risks surrounding them and the ways in which the lay publics can effectively cope with these risks. Radioactive hazard is no more than one of such numerous risks

which surround us in our contemporary age. We have to find the ways whereby we can cope with these numerous risks intelligently by using appropriate technology, methods, manpower, and materials.

Risk communication offers one of such useful instruments to attain this goal. Furthermore, a risk communication system is a social institution which involves interactive 'dialogues' between the communicators and communicatees--- between the industry and the national government on one hand and the lay publics on the other. It also involves an appropriate modeling of the source, the content and the channels of risk communication so that they may be made most effective to a specific audience. The literature already abounds on risk communication, particularly in the United States. [6] It is a pity that no systematic "manual" has been published in Japanese regarding risk commuication and its applications.

7.2. "Macro-level" solutions

Secondly, at the 'macro' level, the emphasis seems to be shifting from a consideration of 'compensation' to a consideration of 'community-building', as the localities are becoming more and more concerned with a long-term social and political development (community-building) and economic growth (effective use of material and human resources) with their own initiative.

Consequently, government and industry should encourage these localities to decide their own future by offering an appropriate technical advice and general formula for community-building. For example, they can offer "brainpower" which might be insufficient in a population-scarce desolate locality. They can help found a secondary or tertiary technical school for the local youth who might otherwise be tempted to leave their home towns and villages for 'big cities' in search of better education and jobs. Exisiting conpensations, subsidies and property tax may be considered as valuable financial resources to attain these

long-term goals.

In view of these factors, new symbiotic co-existence between a power plant and nearby communities has been recommended by the Subcommittee on Fundamental Issues of Electiricity of the Electric Utility Industry Council, the Ministry of International Trade and Industry. [7] The subcommittee's recommendations cover, among other things, two major objectives:(1) a "symbiosis" between a power plant and local industries, and (2) a "symbiosis" between a power plant and local people. The former includes a wider utilization of physical resources, such as the steam and hot water generated by a power plant, and the siting space of a power plant itself, both as the valuable means to assist local agricultural, fishing and leisure industries. The latter, on the other hand, involves the welfare of local people generally, such as improving the infrastructure, building a modern hospital, and discounting power rates as much as 50% for the residents of a community near to a newly built power plant. It is important to note that these new "privileges" to be granted to a locality and local people under the present recommendations are not to be limited to a new nuclear power plant but to all kinds of new power plants.

8. CONCLUSIONS

In conclusion, it may be said that any reasonable solution for national energy issues will largely rest on the foresight and the initiative of the responsible government and industry. It has become certain by this time that the communication by word alone cannot diminish nagging opposition to nuclear power. It has also become clear that the Faustian seduction, if it should exist, will have only limited effects in the energy issues. In order to restore public trust and enhance public acceptance, further discussions may be required as to: how to shape the global perspectives on the alternative future of energy; how to

develop the institution of effective risk communication whereby people can cope with the uncertain future of energy more rationally; and how to consider both short-term and long-term "symbiosis" between a power plant and the communities and people affected by it.

References

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3. Tanaka Y (1990) An audience analysis of risk communication: segmentation of Tokyo housewives born in the Shohwa era. Proceedings of the XXXIst Annual Congress of the Japanese Social Psychology Association, Kobe, pp38-39 (Text in Japanese)

4. Tanaka Y (1984) Four nuclear paradoxes which affect Japanese public opinion. Proceedings of the Ninth International Symposium held by the Uranium Institute, London, pp148-161

5. In August of 1992, a majority of members of the fishemen's association in Higasidohri in the Aomori Prefecture, finally approved the siting of a nuclear power plant in their neighborhood. In this case, the average amount of compensation to be paid to each member of the fishemen's association is said to be approximately 14,000,000 yen (or US$112,000). (private communication)

6. National Research Council (1989) Improving risk communication. Washington, D. C., National Academy Press.

7. The Report of the the Subcommittee on Fundamental Issues of Electiricity, The Electric Utility Industry Council, The Ministry of International Trade and Industry, June 11, 1992. (Text in Japanese) For a summary of the recommendations, see Gensiryoku-sangyou-simbin, June 18, 1992.